WORLDWIDE PDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

May 3, 2025 – 04:06 PM EDT

PDB ID	:	3KAE / pdb_00003kae
Title	:	Cdc27 N-terminus
Authors	:	Barford, D.; Zhang, Z.; Roe, S.M.
Deposited on	:	2009-10-19
Resolution	:	2.30 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.

Metric	Percentile Ranks	Value
Rfree		0.259
Clashscore		13
Ramachandran outliers		1.1%
Sidechain outliers		4.1%
RSRZ outliers		0.2%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution
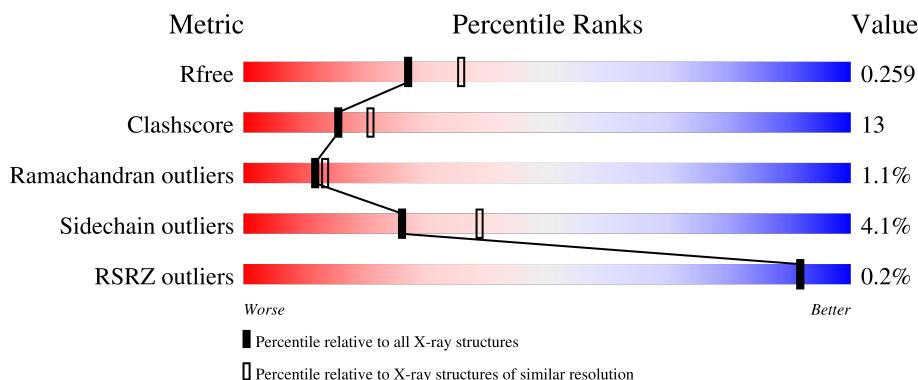
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5963 (2.30-2.30)
Clashscore	180529	6698 (2.30-2.30)
Ramachandran outliers	177936	6640 (2.30-2.30)
Sidechain outliers	177891	6640 (2.30-2.30)
RSRZ outliers	164620	5963 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	242	67% 24% • 7%
1	B	242	67% 27% • 5%
1	C	242	67% 26% • 5%
1	D	242	63% 28% • 6%
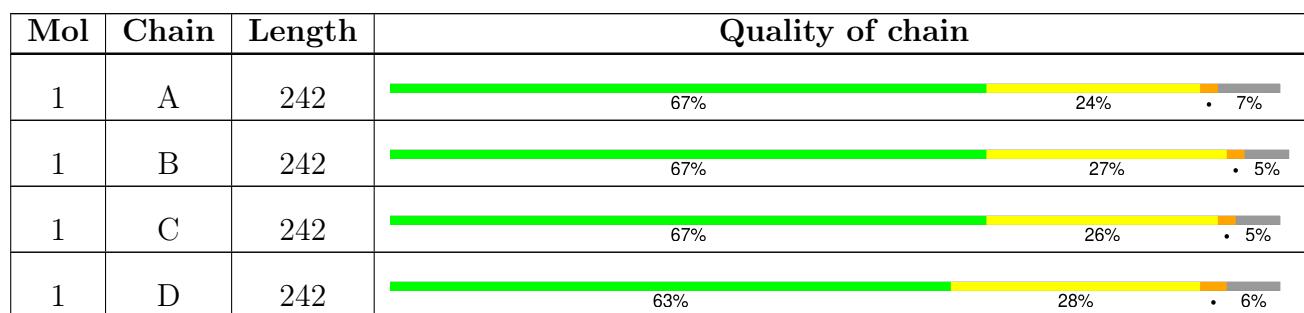
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

| Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GOL	A	243	-	-	X	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 7265 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Possible protein of nuclear scaffold.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	225	Total	C	N	O	S	0	1	0
			1743	1118	287	327	11			
1	B	231	Total	C	N	O	S	0	0	0
			1803	1161	292	337	13			
1	C	231	Total	C	N	O	S	0	0	0
			1808	1158	299	338	13			
1	D	227	Total	C	N	O	S	0	1	0
			1769	1135	293	329	12			

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).
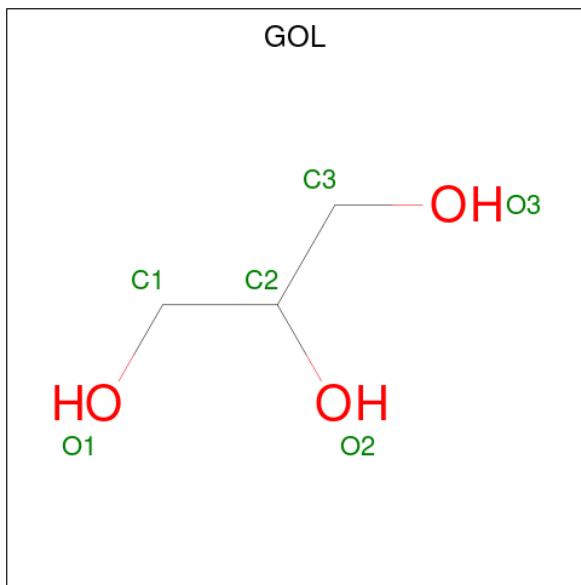
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		
2	C	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total 6	C 3	O 3	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	1	Total 1	Cl 1	0	0

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O_4S).
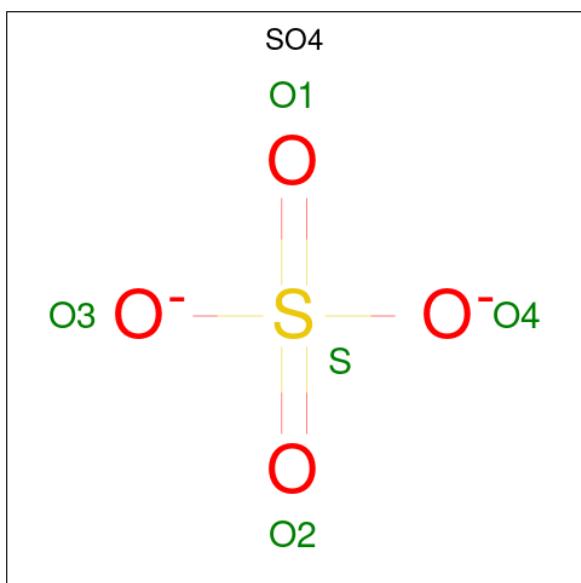
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	D	1	Total 5	O 4	S 1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	28	Total 28	O 28	0	0
5	B	29	Total 29	O 29	0	0
5	C	29	Total 29	O 29	0	0
5	D	32	Total 32	O 32	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Possible protein of nuclear scaffold
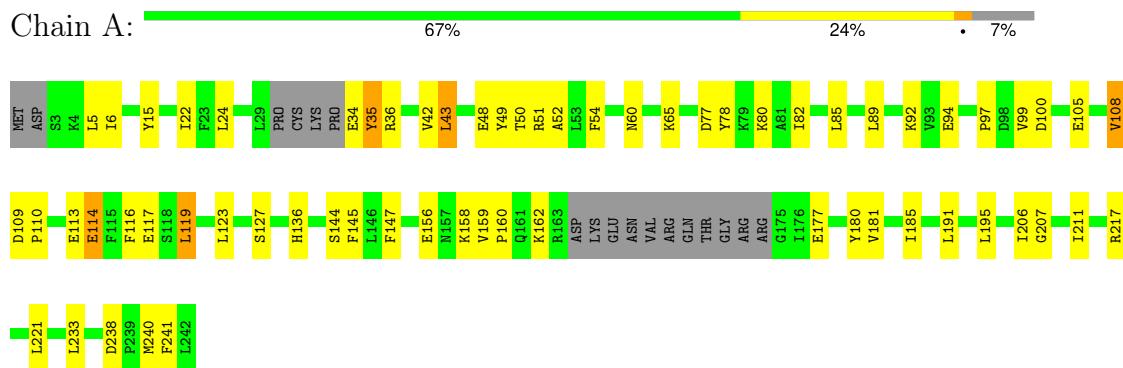
• Molecule 1: Possible protein of nuclear scaffold

• Molecule 1: Possible protein of nuclear scaffold

F231 E232 L233 R236 K237 L242

• Molecule 1: Possible protein of nuclear scaffold

Chain D:

63%   28%   •   6%

MET ASP S3 K4 L5 I6 G7 K8 R14 Y15 I22 F23 L24 C27 L28 L29 P30 C31 K32 PRO GLU Y35 V42 L43 E48 Y49 T50 R51 A52 L53 F54 N60 K65 K74 D77 Y78 K79 K80 A81 I82 L85 L89 K92 V93 E94 P97 D98

V99 D100 E105 V108 D109 P110 E113 E114 F115 F116 E117 S118 L119 L123 S127 H136 R139 K143 S144 F145 L146 F147 E156 N157 K158 V159 P160 Q161 K162 R163 ASP LYS GLU ASN VAL ARG GLN THR GLY ARG ARG G175 I176 E177 Y180 V181 I185 L191

L195 V203 I206 G207 I211 R217 L221 L233 K237 D238 P239 M240 F241 L242
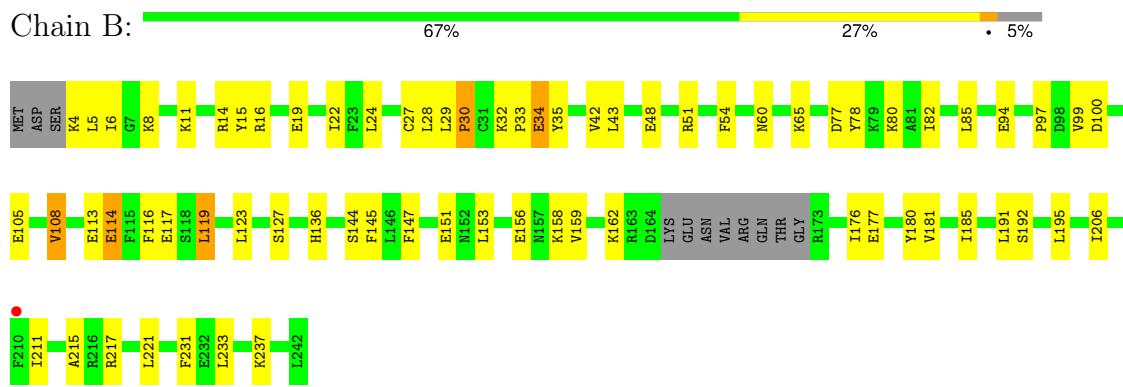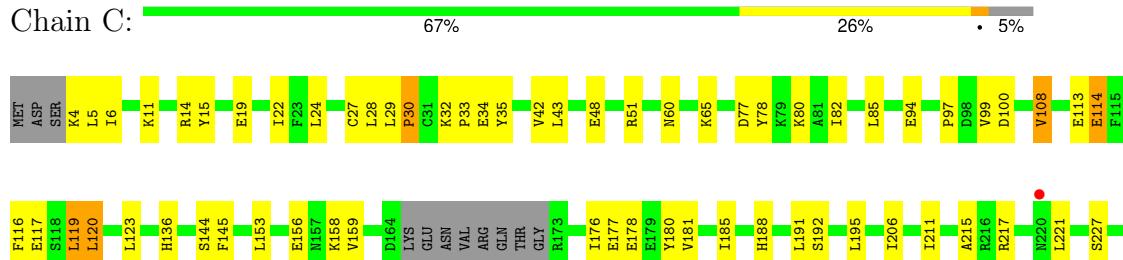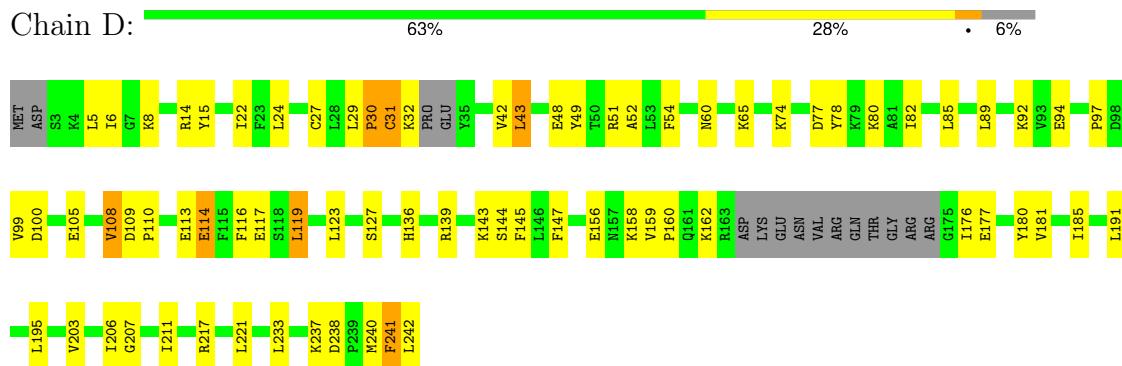
4   Data and refinement statistics   ⓘ

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	34.72Å 81.89Å 87.44Å 101.43° 90.07° 89.99°	Depositor
Resolution (Å)	53.53 – 2.30 53.53 – 2.30	Depositor EDS
% Data completeness (in resolution range)	94.8 (53.53-2.30) 95.0 (53.53-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$< I/\sigma(I) >$ [1]	2.53 (at 2.29Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.217 , 0.262 0.213 , 0.259	Depositor DCC
R_{free} test set	2018 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å^2)	45.7	Xtriage
Anisotropy	0.867	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 61.5	EDS
L-test for twinning[2]	$< |L| > = 0.51, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.456 for h,-k,-l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7265	wwPDB-VP
Average B, all atoms (Å^2)	70.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 44.78 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.4532e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, SO4, CL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#|Z| >5	RMSZ	#|Z| >5
1	A	0.47	0/1776	0.80	0/2395
1	B	0.48	0/1843	0.82	4/2489 (0.2%)
1	C	0.49	0/1847	0.82	4/2494 (0.2%)
1	D	0.51	0/1804	0.86	4/2431 (0.2%)
All	All	0.49	0/7270	0.82	12/9809 (0.1%)

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	241	PHE	N-CA-C	8.81	121.74	110.29
1	D	139	ARG	NE-CZ-NH2	-8.60	111.46	119.20
1	B	32	LYS	CA-C-N	8.22	127.87	119.56
1	B	32	LYS	C-N-CA	8.22	127.87	119.56
1	D	139	ARG	CD-NE-CZ	8.07	135.71	124.40

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1743	0	1658	48	0
1	B	1803	0	1712	49	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1808	0	1719	48	0
1	D	1769	0	1697	52	0
2	A	6	0	8	6	0
2	C	12	0	16	1	0
3	C	1	0	0	0	0
4	D	5	0	0	1	0
5	A	28	0	0	1	0
5	B	29	0	0	2	0
5	C	29	0	0	2	0
5	D	32	0	0	3	0
All	All	7265	0	6810	184	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 13.

The worst 5 of 184 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:48:GLU:HA	2:A:243:GOL:H31	1.51	0.91
1:B:85:LEU:HD11	1:B:119:LEU:HD12	1.58	0.84
1:A:85:LEU:HD11	1:A:119:LEU:HD12	1.58	0.83
1:C:85:LEU:HD11	1:C:119:LEU:HD12	1.61	0.82
1:D:85:LEU:HD11	1:D:119:LEU:HD12	1.60	0.81

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	220/242 (91%)	212 (96%)	6 (3%)	2 (1%)	14	17
1	B	227/242 (94%)	217 (96%)	7 (3%)	3 (1%)	10	11

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	227/242 (94%)	218 (96%)	7 (3%)	2 (1%)	14	17
1	D	222/242 (92%)	213 (96%)	6 (3%)	3 (1%)	9	9
All	All	896/968 (93%)	860 (96%)	26 (3%)	10 (1%)	12	13

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	162	LYS
1	A	35	TYR
1	B	162	LYS
1	C	34	GLU
1	D	162	LYS

5.3.2   Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	179/219 (82%)	172 (96%)	7 (4%)	27	41
1	B	188/219 (86%)	181 (96%)	7 (4%)	29	43
1	C	189/219 (86%)	181 (96%)	8 (4%)	25	37
1	D	184/219 (84%)	176 (96%)	8 (4%)	25	36
All	All	740/876 (84%)	710 (96%)	30 (4%)	26	39

5 of 30 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	43	LEU
1	D	119	LEU
1	C	114	GLU
1	D	195	LEU
1	D	94	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	60	ASN
1	C	188	HIS
1	D	60	ASN
1	D	46	ASN
1	B	46	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	GOL	A	243	-	5,5,5	0.39	0	5,5,5	0.39	0
4	SO4	D	243	-	4,4,4	0.24	0	6,6,6	0.12	0
2	GOL	C	244	-	5,5,5	0.40	0	5,5,5	0.37	0
2	GOL	C	245	-	5,5,5	0.46	0	5,5,5	0.45	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	A	243	-	-	0/4/4/4	-
2	GOL	C	244	-	-	4/4/4/4	-
2	GOL	C	245	-	-	3/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	244	GOL	O1-C1-C2-C3
2	C	244	GOL	C1-C2-C3-O3
2	C	245	GOL	O1-C1-C2-C3
2	C	245	GOL	C1-C2-C3-O3
2	C	245	GOL	O2-C2-C3-O3

There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	243	GOL	6	0
4	D	243	SO4	1	0
2	C	245	GOL	1	0

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6   Fit of model and data ⓘ

6.1   Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	225/242 (92%)	-0.19	0	100	100	38, 69, 102, 124	1 (0%)
1	B	231/242 (95%)	-0.17	1 (0%)	89	89	40, 68, 101, 124	0
1	C	231/242 (95%)	-0.18	1 (0%)	89	89	40, 68, 101, 124	0
1	D	227/242 (93%)	-0.11	0	100	100	38, 69, 104, 126	1 (0%)
All	All	914/968 (94%)	-0.17	2 (0%)	92	92	38, 69, 103, 126	2 (0%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	210	PHE	2.2
1	C	220	ASN	2.2

6.2   Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3   Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4   Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	GOL	A	243	6/6	0.95	0.12	64,91,92,96	0
2	GOL	C	244	6/6	0.97	0.11	88,90,102,102	0
2	GOL	C	245	6/6	0.98	0.06	54,69,88,92	0
3	CL	C	243	1/1	0.98	0.10	82,82,82,82	0
4	SO4	D	243	5/5	0.98	0.09	126,128,132,134	0

6.5 Other polymers ⓘ

There are no such residues in this entry.